# ELECTROPHYSICAL INSTALLATION BASED ON BARRIER DISCHARGE FOR HYDROCARBON SYNTHESIS

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In an electrophysical installation, a mixture of $CH_4$ and $C_2H_6$ was treated by a barrier discharge. The hydrocarbon conversion was experimentally recorded. For the developed plasma chemical reactor, with help of the solver "ZDPlasKin", a theoretical evaluation of the plasma kinetics processes occurring in the discharge was carried out. The experimental results are in good agreement with the theoretical estimate.

To the plasma chemical reactor (PCR) with a coaxial configuration of electrodes with the help of a special generator rectangular voltage pulses were applied with an amplitude of 12 kV, a duration of 60 μs with a frequency of 4 kHz [1]. In a mixture of $CH_4$ (98.2% vol.) and $C_2H_6$ (1.8% vol.), a barrier discharge was initiated to activate and stimulate chemical reactions. During the experiments, the volume of $CH_4$, $C_2H_4$, $C_2H_6$ and $H_2$ at the outlet from the PCR was measured (see table). For a theoretical evaluation of the plasma kinetics and chemical composition of the output stream, a 0-dimensional plasma kinetics model based on "ZDPlasKin" [2] was used (see table).

Table – Comparison of the results of measuring the chemical composition of chromatography and the results of modeling

| | Initial mixture | Experiment | Modeling |
|---|---|---|---|
| $N_{CH4}$, $cm^{-3}$ | $265.1 \times 10^{17}$ | $262.4 \times 10^{17}$ | $264.1 \times 10^{17}$ |
| $N_{C2H4}$, $cm^{-3}$ | 0.0 | $1.1 \times 10^{17}$ | $3.6 \times 10^{17}$ |
| $N_{C2H6}$, $cm^{-3}$ | $4.9 \times 10^{17}$ | $5.4 \times 10^{17}$ | $4.6 \times 10^{17}$ |
| $N_{H2}$, $cm^{-3}$ | 0.0 | $1.1 \times 10^{17}$ | $6.1 \times 10^{17}$ |

It can be seen from the table that within the limits of the order of magnitude the experimental and modeling results agree well. Thus, it can be concluded that the 0-dimensional plasma kinetics model acceptability for estimating the most probable ways of the reactions of stimulated barrier discharges in a PCR.

## REFERENCES

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2. S. Pancheshnyi, B. Eismann, G. J. M. Hagelaar, L. C. Pitchford, Computer code ZDPlasKin, http://www.zdplaskin.laplace.univ-tlse.fr (University of Toulouse, LAPLACE, CNRS-UPS-INP, Toulouse, France, 2008).